Brief information about the project

Title	AP23488028 «Development of a technology for the production and testing of algobacterial biopreparations that enhance the resistance and productivity of agricultural crops»
Relevance	The practice of applying chemical fertilizers over the past two decades has led to significant changes in soil structure and degradation. As a result, the current situation demands a fundamental shift in agricultural practices. Considering Kazakhstan's strategic goal to become a global player in the production of environmentally friendly agricultural products, transitioning to organic farming and the use of biofertilizers could be a viable solution. These biofertilizers offer far more benefits than may initially appear, especially in terms of their environmental safety. The relevance of this research stems from the urgent need to develop Kazakhstan's domestic biofertilizer market, which is viewed as a future trend and an essential component of sustainable soil and crop management. Currently, the bio-based products available on the Kazakhstani market are predominantly of foreign origin and are mostly developed using only heterotrophic PGPM (Plant Growth-Promoting Microorganisms). In contrast, the phototrophic microorganisms being investigated in this project possess significant capabilities such as photosynthesis, nitrogen fixation, and the synthesis of biologically active and growth-promoting compounds. These features make them highly promising for enhancing nitrogen and phosphorus levels, along with other essential macro- and micronutrients in the soil, ultimately contributing to increased soil fertility.
Goal	To develop and produce a biopreparation (or biopreparations) based on a consortium of phototrophic and heterotrophic PGPM (Plant Growth-Promoting Microorganisms), providing protective effects and enhancing the productivity of agricultural crops; to register the resulting product and develop a technological protocol for its effective application.
Tasks	1. To construct and study various microbial consortia composed of active strains of phototrophic and heterotrophic PGPM (Plant Growth-Promoting Microorganisms) with plant growth-promoting effects. 2. To investigate the biostimulant activity of the obtained consortia on agricultural crops under laboratory conditions. 3. To study the protective properties of consortia composed of microalgae and PGP bacteria against soil phytopathogenic microorganisms. 4. To optimize the conditions for large-scale cultivation of the consortia for biomass production as the basis for biopreparations. 5. To evaluate the impact of the experimental biopreparation samples on the biological activity of soil. 6. To conduct field trials of the experimental biopreparation samples based on algocyanobacterial consortia. 7. To determine the storage conditions of the biopreparation. 8. To prepare an application for the state registration of

	the biopreparation. 9. To develop a scientifically grounded technological protocol for the production and application of biopreparations based on algocyanobacterial consortia.
Expected and Achieved Results	1. Several variants of algocyanobacterial consortia (ACBC) consisting of 2, 3, 4 or more components will be formed and tested. The interactions between microalgae, cyanobacteria, and PGP bacteria within the constructed associations will be studied. 2. Vegetative and micro-vegetative experiments will be conducted to assess the impact of the developed consortia on rice growth, in comparison with chemical fertilizers and biofertilizers (germination rate, shoot and root length, tillering). 3. The effect of the microalgae and PGP bacteria consortium on pathogens causing infectious diseases in agricultural crops will be studied. Optimal application rates of the biopreparation for infection suppression will be calculated. 4. Nutrient media and cultivation conditions (temperature, pH) will be optimized to enhance the practical value of the consortia, and biomass will be obtained. A biochemical analysis of the biomass composition will be performed. 5. The influence of the consortium biomass on seed germination, growth, and development of rice and barley seedlings under field conditions will be investigated to determine the optimal doses, timing, and application methods. 6. Soil enzymatic activity and microbiological composition will be analyzed before and after application of the obtained consortium to identify quantitative changes in the structure of key physiological groups of soil microorganisms in agrocenoses. 7. A metagenomic analysis of the soil will be carried out before and after the application of the biopreparation to evaluate the potential of the developed consortium to stimulate the native soil microbiome. 8. Documentation required for the registration of the biopreparation will be compiled: test result reports, production trial assessment report, analysis reports on biopreparation composition, and economic efficiency calculations. Storage conditions for the biopreparation will also be determined. 9. A technological protocol for the production and application of biopreparations based on algocyanobacterial consortia (ACBC) will be developed, along with a patent application for the invention.
Names and Surnames of Research Group Members with Their Identifiers (Scopus Author ID, Researcher ID, ORCID, if available) and Links to Corresponding Profiles	1. Sadvakasova assemgul ResearcherID – X-6084-2019 Scopus Author ID – 55978114100, https://orcid.org/0000-0003-1456-5320 https://www.scopus.com/authid/detail.uri?authorId=55978114100 https://www.webofscience.com/wos/author/record/1865165 2. Bauenova Meruyert Researcher ID: ABD-6906-2021 Scopus Author ID: 57201014777ORCID https://orcid.org/0000-0003-4117-8449 https://www.scopus.com/authid/detail.uri?authorId=57201014777

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